Calculating Return on Investment for US Department of Defense Modeling and Simulation

Briefing for

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Outline Slide

- Methodological Context
- Relevant Definitions
- Applying to DoD M&S
- Methodology Overview
- Individual Components
- Conclusions
- Possible Ways Ahead

This Methodology

- Advances State of the Art
  - Prior Efforts: Surveys; Improvement insights; or Assessments based on nominal, case-based, business-oriented, multi-attribute views
  - They provided insights but *not* an balanced rigorous approach
- Generates Metrics that Allow
  - Comparisons of M&S to non-M&S alternatives
  - Measuring M&S Contribution and its sub-types (I
  - Calculation of changes in M&S efficiency over tim
  - Non-M&S system evaluations

- Is one that can be
  - Applied to the Enterprise, Applications, and Programs
  - Scaled to fit the scope of the question asked and level of effort
  - Comprehensive with both monetary and qualitative variables

Some Definitions of ROI For M&S

- "A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments."
  - Indicators of value
  - Thus; x years sooner, better results, reduction in number of negative incidents, cost per hour, per year cost savings, etc. are all included

- "(Benefit - Cost) / Cost"[2]
  - A monetary equation calculated in terms of Net-Present-Value dollars
  - Therefore, monetary investments, individual / element / activity costs, cost savings, cost avoidance, cost reductions, etc. are included

- But…

1) ROI Tutorial. E. Degnan, I/ITSEC *2010*
2) What is a pound of training worth? Frameworks and practical examples for assessing Return on Investment in training. Cohn, J & Fletcher, J.

But What ROI is Best for DoD M&S?

- Indicators of value are not derived within a balanced approach
- They're 'numeric anecdotes' - useful but unsatisfying

- Fiscal equations don't capture key dimensions of value

- DoD is a 'not-for-profit' organization with many perspectives

√ M&S value is multi-faceted and realized over many years

√

- *M&S ROI metrics need to be within an rigorous framework*

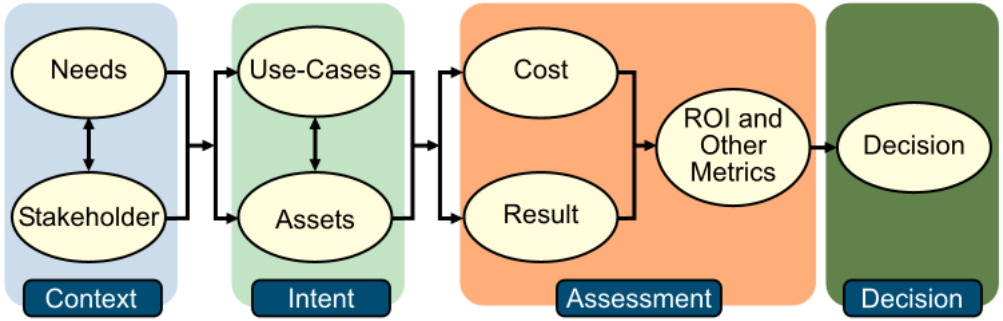
→ *They must reflect the multi-dimensional nature of M&S use*

→ *And they need to include both fiscal and results metrics*

→

M&S ROI Metrics Methodology Overview

- A structured approach, made up of at most eight activities
  - Context Setting
  - Needs Analysis
  - Stakeholder Definition
  - Use Cases Derivation
  - Asset Identification
  - Cost Assessment
  - Results Determination
  - Decision Input

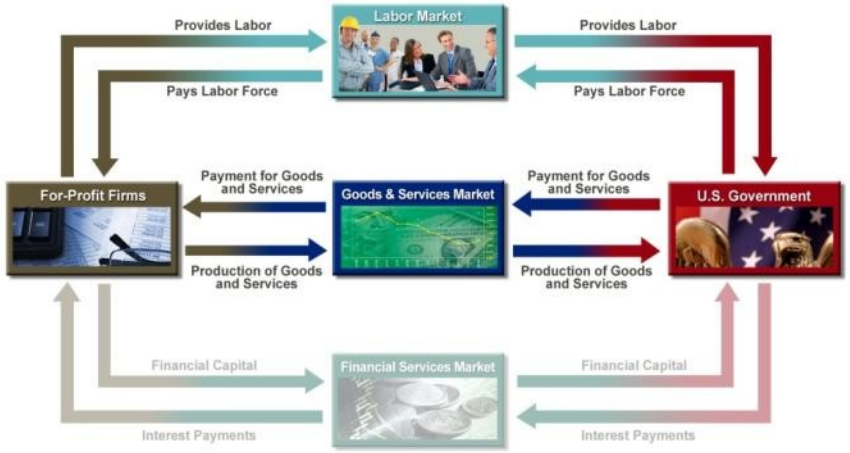


- Each step has features unique to M&S ROI Metric Calculation

M&S ROI Metrics Methodology Components

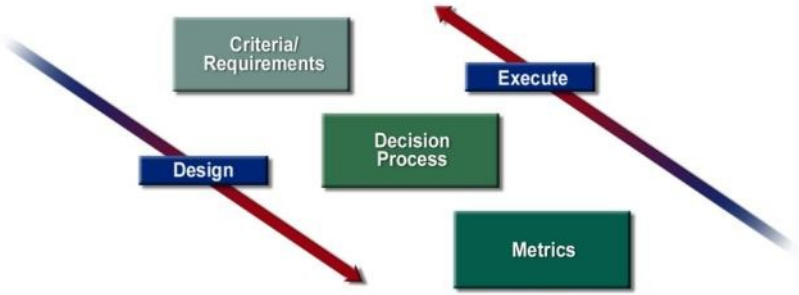
1. Market Context and Business Practice

Discriminating DoD M&S technology investment from commercial practice. DoD does not calculate profit and loss and has very different "time to market" drivers.



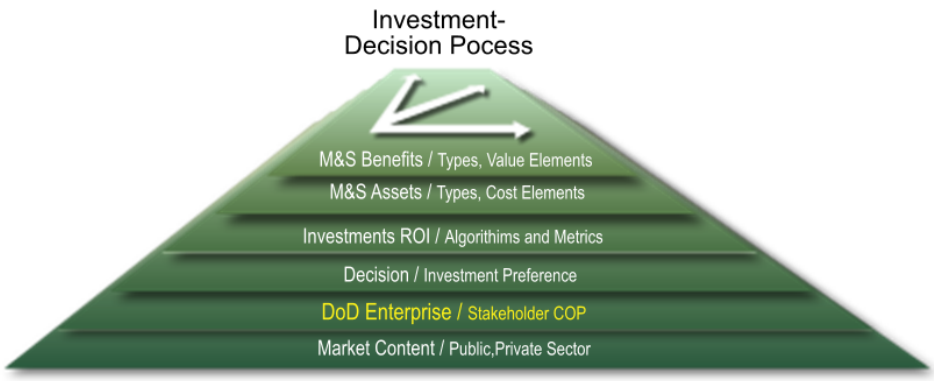
2. Needs and Requirements Analyses

Using a top-down approach to define requirements being met with M&S, associated decision processes, and relevant metrics. Then going bottom-up to measure metrics that inform decisions to meet requirements.



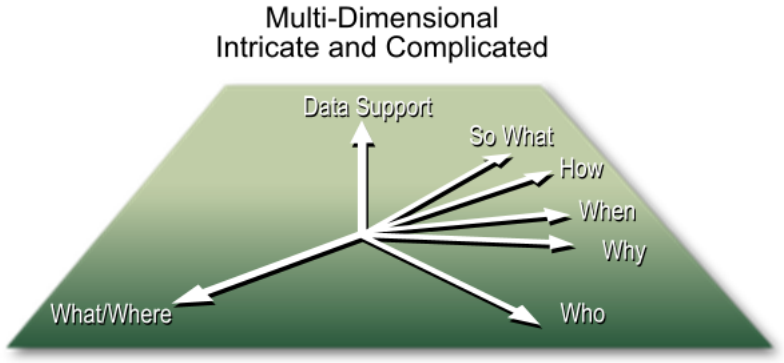
3. Stakeholder and Community of Practice

Recognizing how sensitively investment preferences vary across the DoD M&S communities and action-agent role players.


Investment-
Decision Pocess
M&S Benefits / Types, Value Elements
M&S Assets / Types, Cost Elements
Investments ROI / Algorithims and Metrics
Decision / Investment Preference
DoD Enterprise / Stakeholder COP
Market Content / Public,Private Sector

4. Use Case

Developing use cases (explication and test scenarios) specifically from the application domain to help refine methodology components and to understand decision input sensitivities



M&S ROI Metrics Methodology Components

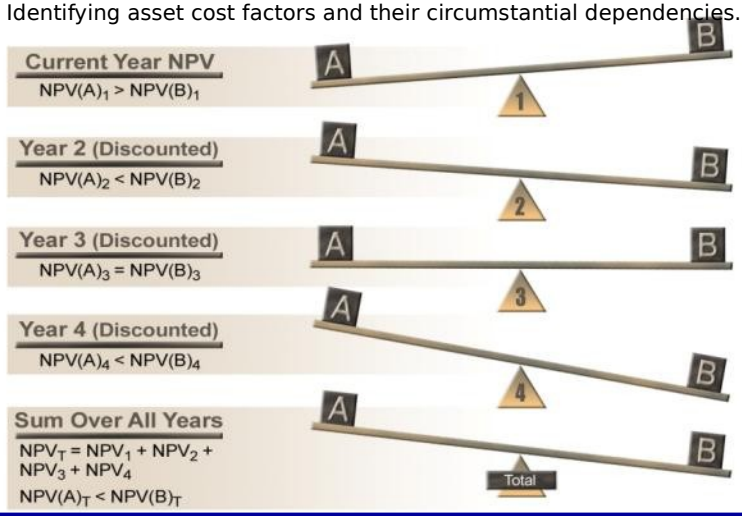
5. Asset Identification

Addressing the set of processes and product artifacts that are candidates for DoD M&S investment and identifying their cost and result dependencies.

Hardware	Software	Networks	Facilities	People	Products & Procedures
Computers	Models	Lines	Buildings	Expertise	Plan
Electronic HW	Simulation	Architecture	Labs	Experience	Policies
Hardware in the Loop	Tools (CAD/CAM)	Transaction Protocols	Ranges	Skills / Education	Analysis Results
Mock-ups	Data / Databases		Physical Models	Operational Knowledge	Conceptual Models
Spares	Repositories				Management Processes
					Standards

6. Asset Investment Cost Analysis

Identifying asset cost factors and their circumstantial dependencies.



7. Asset Results Analysis

Identifying asset result factors and their circumstantial dependencies.
Approximately four hundred result metric types are currently postulated.

Enterprise

Leadership, Implementation, Business, Infrastructure, System of Systems

Enterprise metrics reflect orchestration and management-type activities

Communities

Design, manufacturing, Sustainment, Time to Market — **Acquisition**

Alternatives, Complexity, Sensitivity, Result Time — **Analysis**

Projection, Familiarity, Comprehensive, Decision Time — **Operations Support**

Test Design, Augmentation, Extrapolation, Completion Time — **Test & Evaluation**

Availability, Scenario Variation, Experimental, Retention Time — **Training**

Discovery, Doctrine, Technology, Cycle Time — **Experimentation**

Programs

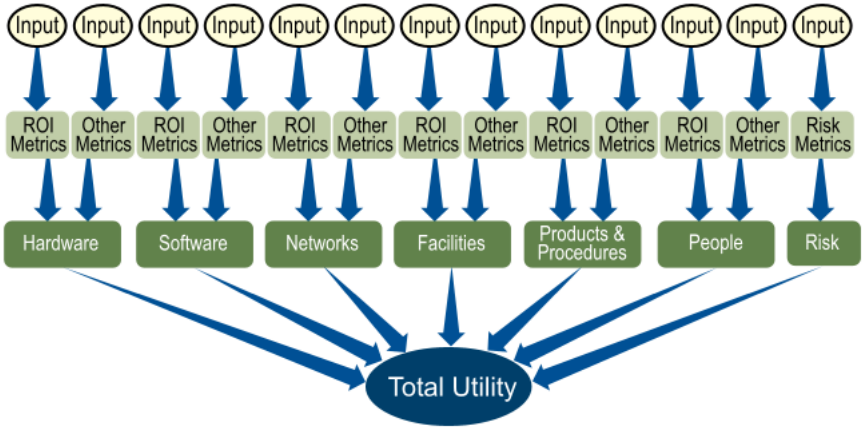
Applicability, Availability, Affordability, Rigorousness, Engaging, Usability, Creditability, Technical

Community metrics reflect more specific uses and yet can include both enterprise -type and program-type metrics (when the program crosses boundaries within / between a community (ies)

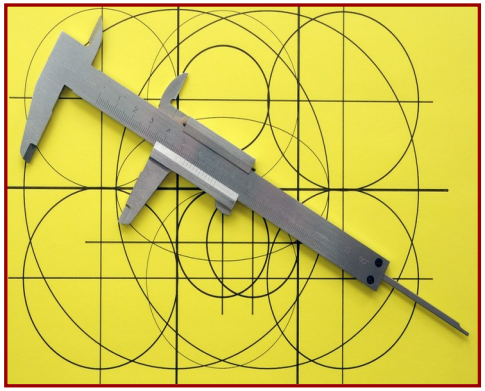
Program metrics reflect the key dimensions of individual M&S system developments or M&S use within platform development or programs

8. Investment Decision Process

Applying a Multi-Attribute Decision Making (MADM) network that is robust, relatively explainable, objective, consistent, and once established, can be executed fairly simply



Conclusions



- By viewing investments from
  - A DoD Enterprise perspective
  - Evaluating investment over multiple years
  - Measuring metrics developed in this way
  - Producing an ROI-like result
  - DoD can evaluate and prioritize M&S investments!
- Using these methods should allow DoD to make M&S investments that result in an increased ROI when compared to the current state
- This approach is also applicable to other US Government Agencies

Possible Paths from Here

- An important next step in the development and use of this methodology is its application
- Such an application could be a
  - Historical examination
  - Enterprise-wide assessment
  - Application oriented investigation (training, analysis, support to operations, acquisition, experimentation, logistics, etc.)
  - Instructional setting analysis of potential M&S (and G) support options
  - Prediction of needed future M&S R&D, S&T, etc. investment
- We are looking for champions, sponsors, programs, commands, …